

DO NOT OPEN THIS TEST BOOKLET TILL YOU ARE ASKED TO DO SO

TR/DLTI/MECH/P-II/17

Test Booklet Series

**TEST BOOKLET
GENERAL ABILITY TEST**

(Signature of the Candidate)

(PART- II)
(Mechanical Engineering)



(Invigilator's Signature)

Time Allowed : 1 hour 30 minutes (One hour thirty minutes)

Maximum Marks : 60

I N S T R U C T I O N S

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE SCREENING TEST, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES NOT HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. **ENCODE CLEARLY THE TEST BOOKLET SERIES IN THE APPROPRIATE PLACE IN THE ANSWER SHEET BY BLACK BALL POINT PEN ONLY.**
3. This Test Booklet contains 60 items (questions). Each question, carrying 1 (one) mark only, has four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the most appropriate. In any case, choose **ONLY ONE** response for each item.
4. You have to mark all your responses by **Black Ball Point Pen only** on the separate Answer Sheet provided. See directions in the Answer Sheet.
5. All items carry equal marks.
6. Before you proceed to mark in the Answer Sheet the responses to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet.
7. After you have completed filling in responses on the Answer Sheet and the Screening Test is completed, you should handover the Answer Sheet to the Invigilator only. You are permitted to take the Test Booklet with you.
8. Sheets for rough work are appended on the Test Booklet at the end.
9. **Penalty for wrong answers :**
 - (a) There will be four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third** of the marks assigned to that question will be deducted as penalty.
 - (b) If a candidate gives more than one answer, it will be treated as a **Wrong Answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
 - (c) If a question is left blank, i.e. no answer is given by the candidate, there will be **no penalty** for that question.

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Four options are given against each of the following questions. Select the best/correct option from among the four options and encode in the answer sheet by **Black Ball Point Pen** only as per example given below :

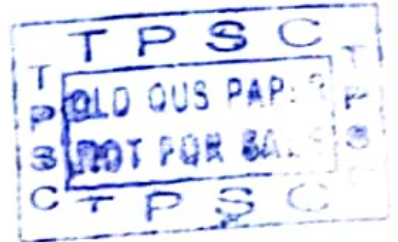
Example : The capital of India is

(A) Delhi

☒ New Delhi

(C) Indraprastha

(D) None of these



1. The expected time (t_e) of a PERT activity in terms of Optimistic time (t_o), pessimistic time (t_p) and most likely time (t_l) is given by

(A) $t_e = \frac{t_o + 4t_l + t_p}{6}$

(B) $t_e = \frac{t_o + 4t_p + t_l}{6}$

(C) $t_e = \frac{t_o + 4t_l + t_p}{6}$

(D) $t_e = \frac{t_p + 4t_o + t_l}{6}$

2. If the demand for an item is doubled and the ordering cost halved, the economic order quantity

(A) remains unchanged

(B) increases by a factor of $\sqrt{2}$

(C) is doubled

(D) is halved

3. Which of the following forecasting methods takes a fraction of forecast error into account for the next period forecast ?

(A) simple average method

(B) moving average method

(C) weighted moving average method

(D) exponential smoothening method

4. Flexible manufacturing system production methodology is applicable to situation where the lot size of a product ranges between

(A) 100 to 500 items

(B) 100 to 1000 items

(C) 100 to 1500 items

(D) None of the above

5. A shaft (diameter $20^{+0.05}_{-0.15}$ mm) and a hole (diameter $20^{+0.20}_{+0.1}$ mm) when assembled would yield
 (A) transition fit
 (B) interference fit
 (C) clearance fit
 (D) none of these
6. A hole 1 mm is to be drilled in glass. It would best be done by
 (A) laser drilling
 (B) plasma arc drilling
 (C) ultrasonic method
 (D) electro beam drilling
7. In the relation for cutting tool life $VT^n = c$, the numerical value of n for high speed steel tools vary in the range
 (A) 0.1 to 0.15
 (B) 0.20 to 0.25
 (C) 0.25 to 0.40
 (D) 0.40 to 0.55
8. In electrical resistance welding
 (A) voltage is high and current is low
 (B) voltage is low and current is high
 (C) both voltage and current are high
 (D) both voltage and current are low
9. A tooth paste tube can be produced by
 (A) solid forward extrusion
 (B) solid backward extrusion
 (C) hollow backward extrusion
 (D) hollow forward extrusion
10. The ratio between the pattern shrinkage allowance of steel and cast iron is about
 (A) 1 : 1
 (B) 2 : 1
 (C) 1 : 2
 (D) 1 : 1.5
11. Line imperfection in a crystal is called
 (A) Schottky defect
 (B) Frenkel defect
 (C) Edge dislocation
 (D) Miller defect
12. If the body has a large thermal conductivity and a corresponding low film heat transfer coefficient, the heat flow to or from the body is controlled principally by
 (A) conduction resistance
 (B) convection resistance
 (C) radiation resistance
 (D) temperature gradient

13. The overall heat transfer coefficient (U) for a composite wall of thickness x_1, x_2, x_3 and of corresponding thermal conductivities k_1, k_2, k_3 is given by equation

(A) $\frac{1}{U} = \frac{k_1}{x_1} + \frac{k_2}{x_2} + \frac{k_3}{x_3}$

(B) $U = \frac{k_1}{x_1} + \frac{k_2}{x_2} + \frac{k_3}{x_3}$

(C) $\frac{1}{U} = \frac{x_1}{k_1} + \frac{x_2}{k_2} + \frac{x_3}{k_3}$

(D) $U = \frac{x_1}{k_1} + \frac{x_2}{k_2} + \frac{x_3}{k_3}$

14. If the thermal conductivity of a material of wall varies as $k_0(1 - \alpha_0)$, the temperature at the centre of the wall will be [Where symbols have their usual meaning]

(A) same as in case of constant thermal conductivity

(B) more than that in case of constant thermal conductivity

(C) less than that in case of constant thermal conductivity

(D) temperature will depend on other factors.

15. The main parts of a vapour compression refrigerating system in sequence are

(A) compressor, condenser, evaporator, throttle valve

(B) compressor, throttle valve, condenser, evaporator

(C) compressor, evaporator, condenser, throttle valve

(D) compressor, condenser, throttle valve, evaporator

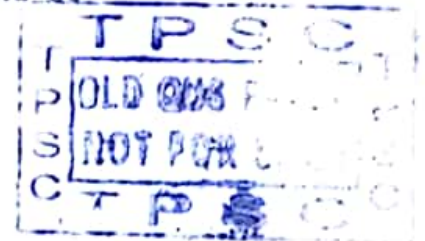
16. The coefficient of performance (c.o.p) of a refrigerator working on a reversed Carnot cycle is 5. The ratio of highest absolute temperature to lowest absolute temperature would be

(A) 1.25

(B) 1.3

(C) 1.4

(D) 1.2



17. In a steady flow reversible isobaric heating of an ideal gas from state 1 to state 2, the equations for heat transfer and work are [Symbols have their usual meaning]

(A) $Q = C_p(T_2 - T_1)$; $W = P(V_2 - V_1)$

(B) $Q = C_p(T_2 - T_1)$; $W = 0$

(C) $Q = \int_1^2 C_p dT$; $W = 0$

(D) $Q = \int_1^2 C_v dT$; $W = P(V_2 - V_1)$

18. In a cyclic process the net heat supplied is 70 kJ/sec. The work obtained from the cycle

- (A) 70 kJ/sec
- (B) zero
- (C) depends on the process
- (D) is less than 70 kJ/sec

19. For the same compression ratio, the thermodynamic cycles in order of decreasing efficiencies are

- (A) Dual, Diesel, Otto
- (B) Dual, Otto, Diesel
- (C) Diesel, Dual, Otto
- (D) Otto, Dual, Diesel

20. The slope of constant pressure lines on temperature-entropy diagram is given by [Symbols have their usual meaning]

- (A) $\frac{S}{T}$
- (B) $\frac{T}{S}$
- (C) $\frac{T}{C_p}$
- (D) $\frac{C_p}{T}$

21. Hydrodynamic and thermal boundary layer thickness are equal for Prandtl number

- (A) equal to zero
- (B) less than 1
- (C) equal to 1
- (D) more than 1

22. A convergent divergent nozzle is designed for a throat pressure of 2.2 MPa. If the pressure at the exit is 2.3 MPa, then the nature of the flow at the exit will be

- (A) supersonic
- (B) sonic
- (C) subsonic
- (D) not predictable with the available data.

23. When α is absorptivity, ρ is reflectivity and τ is transmissivity, then for diathermanous body, which of the following relation is valid ?

- (A) $\alpha = 1, \rho = 0, \tau = 0$
- (B) $\alpha = 1, \rho = 0, \tau = 1$
- (C) $\alpha = 0, \rho = 1, \tau = 0$
- (D) $\alpha + \rho = 1, \tau = 0$

24. The velocity components for a two dimensional incompressible flow of a fluid are $u = x - 4y$ and $v = -y - 4x$. It can be concluded that

- (A) the flow does not satisfy the continuity equation
- (B) the flow is rotational
- (C) the flow is irrotational
- (D) none of the above

25. A $\frac{1}{25}$ model of a ship is to be tested for estimating the wave drag. If the speed of the prototype is 1.0 m/s, then the speed at which the model must be tested is

- (A) 0.04 m/s
- (B) 0.2 m/s
- (C) 5.0 m/s
- (D) 25.0 m/s

26. A good refrigerant should have

- (A) high latent heat of vaporization and low freezing point
- (B) high operating pressures and low freezing point
- (C) high specific volume and high latent heat of vaporization
- (D) low cop and low freezing point

27. An electric cable of aluminium conductor ($k = 240 \text{ W/mk}$) is to be insulated with rubber ($k = 0.15 \text{ W/mk}$). The cable is to be located in air ($h = 6 \text{ W/m}^2$). The critical thickness of insulation will be

- (A) 25 mm
- (B) 40 mm
- (C) 160 mm
- (D) 800 mm

28. The effect of friction on flow of steam through nozzle is to

- (A) decrease the mass flow rate and to increase the wetness at the exit
- (B) increase the mass flow rate and to increase the exit temperature
- (C) decrease the mass flow rate and to decrease the wetness of the steam
- (D) increase the exit temperature, without any effect on the mass flow rate

29. Once through boiler is named as such because

- (A) flue gas passes only in one direction
- (B) there is no recirculation of water
- (C) air is sent through the same direction
- (D) steam is sent out only in one direction

30. For evaporators and condensers, for the given conditions, the logarithmic mean temperature difference (LMTD) for parallel flow is

- (A) equal to that for counter flow
- (B) greater than that for counter flow
- (C) smaller than that for counter flow
- (D) very much smaller than that for counter flow.

31. In full depth $14\frac{1}{2}^\circ$ involute system, the smallest number of teeth in a pinion which meshes with rack without interference is

- (A) 12
- (B) 16
- (C) 25
- (D) 32

32. Which of the following is true (μ = Poisson's ratio) ?

- (A) $0 < \mu < +\frac{1}{2}$
- (B) $1 < \mu < 0$
- (C) $1 < \mu < -1$
- (D) $\alpha < \mu < -\alpha$

33. The relationship between constants E, G and K is given by (where the symbols have their usual meaning)

(A) $E = \frac{G + 3K}{9 KG}$

(B) $E = \frac{3G + K}{9 KG}$

(C) $E = \frac{9 GK}{G + 3K}$

(D) $E = \frac{9 GK}{3K + G}$

34. For the two shafts connected in parallel, find which statement is true?

- (A) torque in each shaft is the same
- (B) shear stress in each shaft is the same
- (C) angle of twist of each shaft is the same
- (D) torsional stiffness of each shaft is the same

35. Feed gear box for a screw cutting lathe is designed on the basis of

- (A) geometric progression
- (B) arithmetic progression
- (C) harmonic progression
- (D) none of these

36. The curve traced by a point on the circumference of a circle which rolls along the inside of a fixed circle, is known as
- (A) epicycloid
 - (B) hypocycloid
 - (C) involute
 - (D) none of these
37. When Poisson's ratio σ and Young's modulus of elasticity E remains constant, the energy-absorbing capacity of part subject to dynamic forces, is a function of its
- (A) length
 - (B) cross-section
 - (C) volume
 - (D) none of these
38. Which of the following drive system is used in computer numerically controlled machine tools?
- (A) stepper motor
 - (B) low frequency electric motor
 - (C) thyristor controlled DC motor
 - (D) servo controlled pneumatic drives
39. Orsat's apparatus is employed to determine
- (A) ultimate analysis of fuel
 - (B) gravimetric analysis of fuel
 - (C) volumetric analysis of dry products of combustion
 - (D) gravimetric analysis of dry products of combustion
40. Which one of the following sets of constituents is expected in equilibrium cooling of a hypereutectoid steel from austenitic state?
- (A) Ferrite and pearlite
 - (B) Cementite and pearlite
 - (C) Ferrite and bainite
 - (D) Cementite and martensite
41. Crater wear is predominant in
- (A) carbon steel tools
 - (B) tungsten carbide tools
 - (C) high speed steel tools
 - (D) ceramic tools
42. Which one of the following materials will require the largest size of riser for the same size of casting?
- (A) Aluminium
 - (B) Cast iron
 - (C) Steel
 - (D) Copper



43. In an oil lubricated journal bearing, coefficient of friction between the journal and the bearing

- (A) remains constant at all speeds
- (B) is minimum at zero speed and increases monotonically with increase in speed
- (C) is maximum at zero speed and decreases monotonically with increase in speed
- (D) becomes minimum at an optimum speed and then increases with further increase in speed.

44. For a spring controlled governor to be stable, the controlling force (F) is related to the radius (r) by the equation (a and b are constants)

- (A) $F = ar - b$
- (B) $F = ar + b$
- (C) $F = ar$
- (D) $F = \frac{a}{r} + b$

45. Quick return mechanism is an inversion of

- (A) four bar chain
- (B) single slider crank chain
- (C) double slider crank chain
- (D) crossed slider crank chain

46. Inversion of a mechanism is

- (A) changing of a higher pair to lower pair
- (B) obtained by fixing different links in a kinematic chain
- (C) turning it upside down
- (D) obtained by reversing the input and output motion.

47. A Mohr's circle reduces to a point when the body is subjected to

- (A) pure shear
- (B) uniaxial shear only
- (C) equal and opposite axial stresses on two mutually perpendicular planes, the planes being free of shear
- (D) equal axial stresses on two mutually perpendicular planes, the planes being free of shear.

48. The plane of maximum shear stress has normal stress that is

- (A) maximum
- (B) minimum
- (C) zero
- (D) none of these

49. A simply supported beam of span L and flexural rigidity EI , carries a unit point load at its centre. The strain energy in the beam due to bending is

(A) $\frac{L^3}{48 EI}$

(B) $\frac{L^3}{192 EI}$

(C) $\frac{L^3}{96 EI}$

(D) $\frac{L^3}{16 EI}$

50. Design of shafts made of brittle materials is based on

(A) Guest's theory

(B) Rankine's theory

(C) St. Venant's theory

(D) Von Mises theory

51. The efficiency of a diesel engine increases when

(A) cut-off ratio is increased

(B) cut-off ratio is decreased

(C) the speed increases

(D) compression ratio decreases

52. The specific heat of the working fluid in an IC engine increases with

(A) pressure only

(B) pressure and temperature

(C) temperature only

(D) air-fuel ratio

53. Blow-down in a real cycle occurs because

(A) exhaust valve is opened suddenly

(B) exhaust valve opens a few degrees before piston reaches BDC

(C) combustion is never complete

(D) period of overlap is substantial

54. Flame development and subsequent propagation varies cycle by cycle when

(A) engine cooling is improper

(B) the local mixture motion and composition varies

(C) period of overlap is increased

(D) engine has more than one cylinder

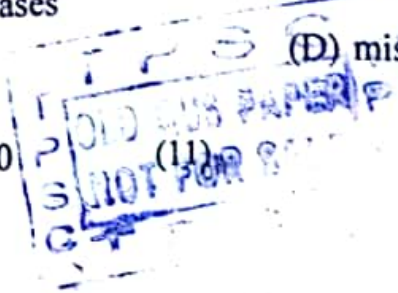
55. The lubricating system used in most of the two stroke engine is

(A) dry sump lubrication system

(B) splash system for a single cylinder engine

(C) wet sump lubrication system

(D) mist lubricating system



56. A car moving with speed u can be stopped in minimum distance x when brakes are applied. If the speed becomes n times, the minimum distance over which the car can be stopped would take the value
- (A) $\frac{x}{n}$
 (B) nx
 (C) $\frac{x}{n^2}$
 (D) n^2x
57. Two particles with masses in the ratio $1:4$ are moving with equal kinetic energies. The magnitude of their linear momentums will conform to the ratio
- (A) $1:8$
 (B) $1:2$
 (C) $\sqrt{2}:1$
 (D) $\sqrt{2}:\sqrt{8}$
58. Ratio of moment of inertia of a circular body about its x -axis to that about y -axis is
- (A) 0.5
 (B) 1.0
 (C) 1.5
 (D) 2.0
59. A person walks up a stalled escalator in 90 seconds. When standing on the same escalator, now moving, he is carried up in 60 seconds. How much time would it take him to walk up the moving escalator?
- (A) 30 sec
 (B) 36 sec
 (C) 45 sec
 (D) 54 sec
60. If the distance between CG of masses m_1 and m_2 is l , then the distance of CG of the composite system from mass m_1 will be
- (A) $\frac{m_1 l}{m_1 + m_2}$
 (B) $\frac{m_2 l}{m_1 + m_2}$
 (C) $\frac{(m_1 - m_2) l}{(m_1 + m_2)}$
 (D) $\frac{m_1}{l(m_1 + m_2)}$

(Space for rough work)

